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Efficiency of parallel DMRG method with multi-site clustering for quasi-two-dimensional quantum systems(New Development of Numerical Simulations in Low-Dimensional Quantum Systems: From Density Matrix Renormalization Group to Tensor Network Formulations)

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# Efficiency of parallel DMRG method with multi-site clustering for quasi-two-dimensional quantum systems

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Since the DMRG method is originally the numerical method for 1-D quantum systems[1], many extended method for an $n$-leg lattice model have been proposed. One of the typical method for the $n$-leg model is the multichain method (see Figure 1). Since the method includes the long-range hopping that the Hubbard model does not contain originally, it is pointed out that the method has some issues in terms of its accuracy[2, 3]. We propose the DMRG method with clustering some sites to decrease the in uence of the long-range hopping (see Figure 2). However, since the DMRG method requires much larger computer resources than the conventional multichain method, the parallelization of the DMRG method is necessary.

In this presentation, we propose the parallelization scheme of the DMRG method with cluster sites, and moreover, we examine whether the DMRG method is more e cient than the conventional one.

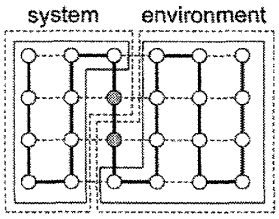


Figure 1: A superblock configuration in the multichain method for a 4-leg model.

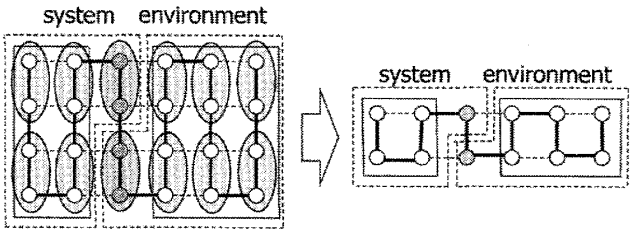


Figure 2: A superblock configuration in the DMRG method with clustering two sites for a 4-leg model (left). This can be regard as a 2-leg model (right).

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